

AMENDMENTS TO THE CLAIMS:

The following Listing of Claims replaces all prior Listings, and versions, of claims in the above-identified application.

Listing of Claims

1-114. (Cancelled)

115. (New) An isolated nucleic acid molecule comprising a nucleic acid sequence encoding an amino acid sequence that is at least 95% identical to SEQ ID NO:66.

116. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid sequence encodes an amino acid sequence that is at least 97% identical to SEQ ID NO:66.

117. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid sequence encodes an amino acid sequence that is at least 99% identical to SEQ ID NO:66.

118. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid sequence encodes an amino acid sequence of SEQ ID NO:66.

119. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid molecule consists essentially of a nucleic acid sequence encoding SEQ ID NO:66.

120. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid sequence is SEQ ID NO:65.

121. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid molecule comprises a nucleic acid sequence encoding SEQ ID NO:62.

122. (New) The isolated nucleic acid molecule of Claim 115, wherein the nucleic acid molecule comprises the nucleic acid sequence of SEQ ID NO:61.

123. (New) A recombinant nucleic acid molecule comprising the nucleic acid molecule of Claim 115, operatively linked to at least one expression control sequence.

124. (New) A recombinant nucleic acid molecule comprising the nucleic acid molecule of Claim 118, operatively linked to at least one expression control sequence.

125. (New) A recombinant nucleic acid molecule comprising the nucleic acid molecule of Claim 120, operatively linked to at least one expression control sequence.

126. (New) A recombinant cell that expresses the recombinant nucleic acid molecule of Claim 123.

127. (New) The recombinant cell of Claim 126, wherein the recombinant cell is a plant cell.

128. (New) The recombinant cell of Claim 126, wherein the recombinant cell is a microbial cell.

129. (New) The recombinant cell of Claim 130, wherein the microbial cell is from a *Thraustochytrid*.

130. (New) The recombinant cell of Claim 131, wherein the *Thraustochytrid* is a *Schizochytrium*.

131. (New) A recombinant cell that expresses the recombinant nucleic acid molecule of Claim 124

132. (New) The recombinant cell of Claim 131, wherein the recombinant cell is a plant cell.

133. (New) The recombinant cell of Claim 131, wherein the recombinant cell is a microbial cell.

134. (New) The recombinant cell of Claim 133, wherein the microbial cell is from a *Thraustochytrid*.

135. (New) The recombinant cell of Claim 134, wherein the *Thraustochytrid* is a *Schizochytrium*.

136. (New) A recombinant cell that expresses the recombinant nucleic acid molecule of Claim 125.

137. (New) The recombinant cell of Claim 136, wherein the recombinant cell is a plant cell.

138. (New) The recombinant cell of Claim 136, wherein the recombinant cell is a microbial cell.

139. (New) The recombinant cell of Claim 138, wherein the recombinant cell is a *Thraustochytrid* microorganism.

140. (New) The recombinant cell of Claim 139, wherein the recombinant cell is a *Schizochytrium*.

141. (New) A method to produce at least one polyunsaturated fatty acid (PUFA), comprising culturing under conditions effective to produce the PUFA, an organism that expresses a PKS system for production of PUFAs, wherein the organism expresses the recombinant nucleic acid molecule of Claim 123.

142. (New) The method of Claim 141, wherein the organism produces a polyunsaturated fatty acid (PUFA) profile that differs from an organism that does not express the recombinant nucleic acid molecule of Claim 123.

143. (New) The method of Claim 142, wherein the organism produces docosahexaenoic acid (DHA), and wherein the production of DHA is increased in the organism as compared to an organism that does not express the recombinant nucleic acid molecule of Claim 123.

144. (New) The method of Claim 141, wherein the organism is a microorganism.

145. (New) The method of Claim 141, wherein the organism is a plant.

146. (New) A method to produce at least one polyunsaturated fatty acid (PUFA), comprising culturing under conditions effective to produce the PUFA, an organism that expresses a PKS system for production of PUFAs, wherein the organism expresses the recombinant nucleic acid molecule of Claim 124.

147. (New) The method of Claim 146, wherein the organism is a microorganism.

148. (New) The method of Claim 146, wherein the organism is a plant.

149. (New) A method to produce at least one polyunsaturated fatty acid (PUFA), comprising culturing under conditions effective to produce the PUFA, an organism that expresses a PKS system for production of PUFAs, wherein the organism expresses the recombinant nucleic acid molecule of Claim 125.

150. (New) The method of Claim 149, wherein the organism is a microorganism.

151. (New) The method of Claim 149, wherein the organism is a plant.

152. (New) A method to produce a genetically modified plant that has a polyunsaturated fatty acid (PUFA) profile that differs from the plant in the absence of the genetic modification, comprising genetically modifying cells of the plant to express a PKS system for production of PUFAs comprising the recombinant nucleic acid molecule of Claim 123.

153. (New) A method to produce a genetically modified plant that has a polyunsaturated fatty acid (PUFA) profile that differs from the plant in the absence of the genetic modification, comprising genetically modifying cells of the plant to express a PKS system for production of PUFAs comprising the recombinant nucleic acid molecule of Claim 124.

154. (New) A method to produce a genetically modified plant that has a polyunsaturated fatty acid (PUFA) profile that differs from the plant in the absence of the genetic

modification, comprising genetically modifying cells of the plant to express a PKS system for production of PUFAs comprising the recombinant nucleic acid molecule of Claim 125.

155. (New) A method to produce lipids enriched for docosahexaenoic acid (DHA), comprising culturing under conditions effective to produce the lipids, a Thraustochytrid microorganism that expresses the recombinant nucleic acid molecule of Claim 123 and that produces DHA, wherein the production of DHA is enriched in the organism as compared to in the absence of the expression of the recombinant nucleic acid molecule of Claim 123.

156. (New) A method to produce lipids enriched for docosahexaenoic acid (DHA), comprising culturing under conditions effective to produce the lipids, a Thraustochytrid microorganism that expresses the recombinant nucleic acid molecule of Claim 124 and that produces DHA, wherein the production of DHA is enriched in the organism as compared to in the absence of the expression of the recombinant nucleic acid molecule of Claim 124.

157. (New) A method to produce lipids enriched for docosahexaenoic acid (DHA), comprising culturing under conditions effective to produce the lipids, a Thraustochytrid microorganism that expresses the recombinant nucleic acid molecule of Claim 125 and that produces DHA, wherein the production of DHA is enriched in the organism as compared to in the absence of the expression of the recombinant nucleic acid molecule of Claim 125.